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# VICTORIAN



# ENTOMOLOGIST

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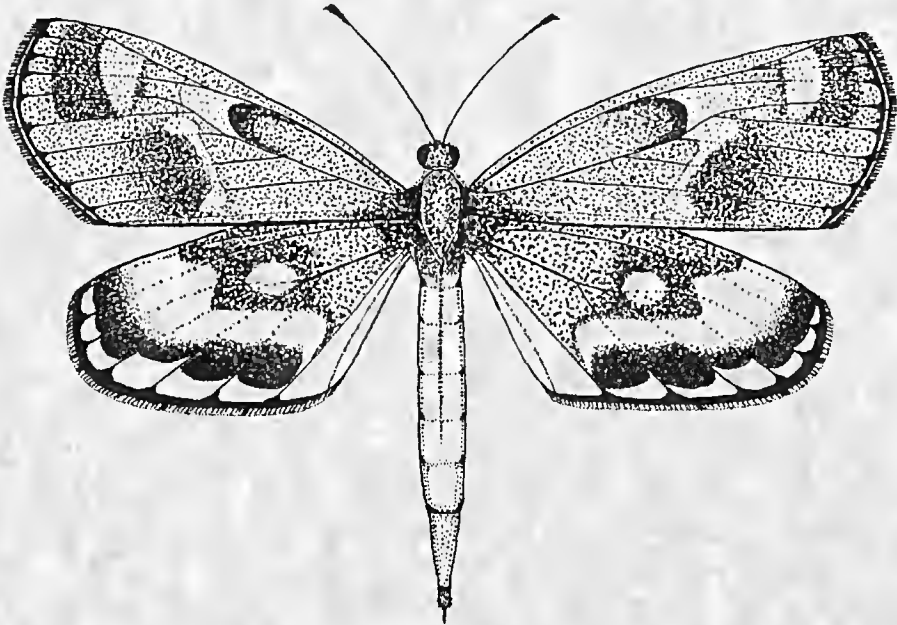
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*News Bulletin of The Entomological Society of Victoria Inc.*

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# THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)

## MEMBERSHIP

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

## OBJECTIVES

The aims of the Society are:

- (a) to stimulate the scientific study and discussion of all aspects of entomology,
- (b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
- (c) to compile a comprehensive list of all Victorian insect species,
- (d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

## MEETINGS

The Society's meetings are held at the 'Discovery Centre', Lower Ground Floor, Museum Victoria, Carlton Gardens, Melway reference Map 43 K5 at 8 p.m. on the third Tuesday of even months, with the exception of the December meeting which is held on the second Tuesday. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

## SUBSCRIPTIONS (2008)

Ordinary Member	\$30 (overseas members \$32)
Country Member	\$26 (Over 100 km from GPO Melbourne)
Student Member	\$18
Electronic (only)	\$20
Associate Member	\$ 7 (No News Bulletin)
Institution	\$35 (overseas Institutions \$40)

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

**LIFE MEMBERS:** P. Carwardine, Dr. R. Field, D. Holmes, Dr. T. New, Dr. K. Walker.

**Cover design** by Alan Hyman.

**Cover illustration:** The pale Sun Moth, *Synemon selene* Klug, is an endangered species restricted to perennial grassland dominated by *Austrodanthonia* in Western Victoria. It is now extinct in SA, and was presumed extinct in Vic. until its rediscovery, in February 1991, by the late Frank Noelker and Fabian Douglas. The Victorian Populations are parthenogenetic with all specimens comprising females, a most unusual trait in the Castniidae. Illustration by Michael F. Braby.

## Minutes of the General Meeting 20 October 2009

**Present:** P. Marriott, M. Fiedel, M. Endersby, I. Endersby, S. Curle, V. Curle, J. Tuttle, P. Carwardine, D. Sands, T. New, W. Moore, D. Hewish, M. Hewish, M. Wicks, K. Dunn, R. Field, D. Stewart, J. Tuttle

**Apologies:** P. Lillywhite, D. Dobrosak, K. Harris, G. Weekes, L. Levens, M. Antos

### Minutes:

Minutes of the previous Members Meeting [Vic.Ent. 39(5): 81-84 (2009)] were accepted. P. Carwardine moved, seconded I. Endersby.

### Correspondence:

- The society has received the latest circular (June 2009 no. 141) from 'The Society for Insect Studies'. In summary, this latest circular contains articles on the recent SFIS meeting at Mitchell Library, the proposed trip to Sulawesi, a request for assistance re Sphingidae research, report on the 4<sup>th</sup> Australian National Insect Collection Moth Meeting, Taxonomists Get Creative, Gigapan, Charles Darwin, book review on Moths of Victoria Part 2, and information on the Butterfly Breeders Convention.
- An invitation for representatives of the Entomological Society of Victoria to attend the Field Naturalists of Victoria presentation of the Australian Natural History Medallion to Professor Richard Shine. This will take place at the Field Naturalists meeting hall – 1 Gardenia Street, Blackburn; 9<sup>th</sup> November 18:30.
- Reception with light buffet cost \$20; free admission from 20:00 for the presentation of the medallion.
- In response to my recent email about beetle contacts in Victoria, Allen Sundholm has asked us to circulate the following:

"I am interested in establishing contact in Victoria and elsewhere in Australia with people with interests in beetle collecting/surveying and exchange of specimens and information, particularly regarding Australian species in the Buprestidae, Cerambycidae, Cetoniinae, and the Scaritini in Carabidae. If anyone is interested please contact me at [entom2@optusnet.com.au](mailto:entom2@optusnet.com.au)"

### Membership:

The following entomological enthusiasts have been duly elected as members of the society:

Cathy Car  
Deborah Arbuckle  
Martin Whatley

Received proposal for new member:

Tiziano Barberi  
Monash University research scientist in the field of stem cell biology; Interests: Insects and Spiders, Macro photography. <http://www.flickr.com/photos/tizianophotos/>

### Treasurers Report:

General account \$5903, Le Souëf account \$5464, publication \$8140.

All current members are paid up to date.

### Editors report:

No editor's report was available as the society is still awaiting the appointment of a new editor.

### Le Souëf Award:

No nominations have been received so far this year.

### Science Talent Search Bursary:

Giulia Oppedisano from Kilvington Girls' Grammar School.

Subject : Science Photography Minor Bursary "The Venus Flytrap"

**Note:** The Conservation and ENTRECS Committees are still in recess

### General Business:

We were lucky to have the opportunity at this meeting to have Dr Don Sands as our guest speaker. Don was down from Queensland and agreed to present on this controversial subject, 'Fire Ecology and the Smaller Animals'. Please refer to page 123 for a summary of Don's presentation.

During the early part of the presentation, Don passed around some literature to supplement his PowerPoint presentation.

### Next Meetings:

If you are planning to attend any of these meetings; please refer to the website for any last minute amendments.

December:	8 <sup>th</sup>	Members meeting	Show n Tell Please note, December's meeting date is second Tuesday of December to try and avoid Christmas celebrations.
<b>2010:</b>			
<i>Month</i>	<i>Date</i>	<i>Planned event</i>	
January:		No meeting	
February:	16 <sup>th</sup>	Members Meeting	
March:	16 <sup>th</sup>	Council Meeting	
April:	20 <sup>th</sup>	AGM	
May:	18 <sup>th</sup>	Council meeting	
June:	15 <sup>th</sup>	Members meeting	
July:	20 <sup>th</sup>	Council meeting	
August:	17 <sup>th</sup>	Members meeting	
September:	21 <sup>st</sup>	Council meeting	
October:	19 <sup>th</sup>	Members excursion	
November:	16 <sup>th</sup>	Council meeting	
December:	14 <sup>th</sup>	Members meeting	Please note, December's meeting date is second Tuesday of December to try and avoid Christmas celebrations.

Meeting closed at 21:33

# The Occurrence of *Opsirhina lechriodes* (Turner, 1911), (Lasiocampidae, Lepidoptera) at Lakes Entrance and Hoddles Creek Victoria

Stephen Smith

The Elusive White-spot, *Opsirhina lechriodes* (Turner, 1911) ranges from central New South Wales to Victoria (Common, 1990). The few Victorian localities include Warrandyte, Blairgowrie and Paynesville (Marriott, 2008).

At Lakes Entrance Victoria on the third of January 1999 a female *O. lechriodes* came to light. She laid eighty eggs the following day. Larvae hatched on the fourteenth of January 1999, accepted a *Eucalyptus* sp. as food-plant and pupated within eight weeks, emerging two weeks later. One pair was retained, the remainder released.

On the eighth of June 2009 a male *O. lechriodes* came to light at Hoddles Creek Victoria, after four am.

Perhaps this species is more widespread than is apparent. A habit of flying late may explain why this moth is seldom encountered (Marriot, personal communication).

## References:

Common, I.F.B. (1990). *Moths of Australia* (Melbourne University Press)

Marriott, P.J. (2008). *Moths of Victoria Part 1* (Entomological Society of Victoria)

# New Range Extensions and Other Data for Selected Butterflies and Sun-Moths From the Maralinga and Far Westcoast Areas of South Australia

R. GRUND

9 Parkers Rd, Torrens Park, Adelaide, S.A., 5062

## Introduction

This paper is based on a follow-up survey of butterflies (and sun-moths) undertaken by the author in the Maralinga and Far West Coast areas of South Australia during 16-27 September 2008. The author previously undertook a reconnaissance survey in the region during 22-30 September 2007 (Grund 2007). The area of interest included Yalata, Ooldea, Immarna, Maralinga, north of Ceduna and along Googs Track in the Yumbarra Conservation Park (to 25km north of the wild-dog gate). The period was mostly warm and sunny, but with one short period of rain in the Yalata area. The areas were mostly in green condition having received reasonable winter rains. One of the main reasons for the survey was to further study the presence of *Croitana* (Hesperiidae) in the region, as during the reconnaissance survey only eggs of this skipper were seen, that unfortunately could not be successfully reared in Adelaide over that following summer.

## Survey Results

A number of interesting, opportunistic butterfly (and sun-moth) observations were made, and are recorded as follows.

### HESPERIIDAE

#### *Antipodia atralba*

This skipper was seen flying during the survey, wherever its hostplant *Galmia lanigera* (Cyperaceae) also occurred. Its presence, based on adults and early stages was seen 12km north of Koonibba and up to 10km north of the dog-gate on Googs Track.

#### *Croitana arenaria pilepudla*

For the first time in the Yalata area this skipper was seen flying. It was seen up to 40km west of Yalata (the limit of the survey). In one locality a large number of its eggs were seen on its local hostplant *Austrostipa acrociliata* (Poaceae), but no flying adults. In another locality there were both eggs and adults. At the latter locality, eggs were seen commonly on *A. acrociliata* and rarely on *A. elegantissima*, but not on other *Austrostipa*. Initially, adults were not seen at this site, but two days later, after some rain and once the sky became clear and sunny again, adults were noted in profusion. These adults were both newly emerged and worn.

These adults exhibited unusual behaviour. No adult flight was noted during the morning of their appearance, but by 1.00pm activity was seen in a sheltered gully area. Initially one or two males were present on the ground in a clear one square metre lek-area within low bluebush-saltbush (Chenopodiaceae), located in full sun in an opening within the tall mallee. These males were in near constant flight in the vicinity, undertaking short territorial battles or short investigative flights, subsequently returning to the clearing. The edge of the breeding grounds containing the hostplant were a short 30m distance away to the south. Five metres to the north was a dirt-track clearing, along which no adults were noted. Immediately adjacent to the track and further to the north for 10m was an area of low flowering shrubbery, and here occasional females were noted feeding on the flowers before flying off and disappearing. No males were ever seen flying with the females in this area. At the male lek area the

males were constantly removed by the author and placed individually in large glass jars, but each time one was removed another soon replaced it, yet no males were ever seen flying in the adjacent perimeter areas. Whether they detected the removal of a male or were constantly monitoring the site in flight from a distal site is not known. Although it was difficult to monitor the exact flight pattern of the adults due to their very rapid flight, it is interpreted that two lek areas occurred at the site, one each for the females and the males, with the former periodically venturing into the male lek to receive a mate. Whether this was normal everyday practice, or was only a one-off event due to the delayed emergence of a large number of adult individuals after a rain event that suppressed adult flying, can only be surmised as the author left the area later in the day.

The skipper was also noted at Immarna (20km west of Ooldea) at a very small-localised roadside area (<100sqm) of *Austrostipa* grass. This grass was in green condition, where initially only eggs of the skipper were noted, that occurred on its larval host *A. acroclita*. The site was examined the next morning when newly emerged male and female adults were seen, mostly feeding at onion weed flowers *Asphodelus fistulosus* (Asphodelaceae), but the odd male was resting on the road. It would seem this site should be unsustainable due to the aridity of the area, yet it must have been active for at least a year to produce the extant adults. No other nearby similar habitat was noted. It is possible it may have been resultant from a dune-soak (similar to Ooldea) although no major effort was made by the author to locate the source. However, it does indicate the skipper is very resilient and resourceful, with very mobile, nomadic vagrant tendencies, having adapted well to inland arid habitat by managing to undertake long-distance dispersal forays after ephemeral local rains.

During the previous reconnaissance survey, eggs of this skipper were encountered in roadside grass verge growing along the Eyre Highway at 10km west of Iron Knob and in the Poochera area, but no eggs or adults were seen at these localities during the 2008 survey. The former area was considerably drier compared to 2007.

A comparison of morphologies (Figs 1-19) for adults from northeast Eyre Peninsula (the type locality for *C.a. pilepudla*), and from Immarna and Yalata, indicates the uppersides and undersides are quite variable, including the presence or non-presence of dividing brown veins on the orange-yellow central patch on the upperside of the hindwings, the presence being a presumed autapomorphy for *Croitana aestiva* (Edwards 1979). A further presumed synapomorphy for *C. aestiva* and *Croitana croites*, being a non-confluent dark subterminal band on the hindwing underside, also occurs in some of the *C.a. pilepudla* specimens from Immarna and Yalata. Although the sampling rate was low, each locality area seemed to contain individual adults having a unique morphology. However, there were also adults from each area with similar morphologies, suggesting the adults are reasonably mobile in the region, and which essentially indicate a *C.a. pilepudla* mega-population forming a phenotypic (environmental) cline across the region with respect to morphology. The presence of the skipper at the arid site of Immarna might also suggest its presence at other localities further west towards the Western Australian border. The early stages for *Croitana* populations at Immarna, Yalata and northeast Eyre Peninsula are identical (Grund 1998-2009), and which also have a close resemblance to the early stages for Kalgoorlie *C. croites* illustrated in Graham (1988), the latter taxon also utilising *Austrostipa platydiaeta*, a hostplant for the skipper in South Australia.

Some eggs acquired from Immarna and Yalata were successfully reared in Adelaide on *Enteropogon acicularis* and *E. ramosus* (Poaceae), hostplants for *C.a. arenaria*, producing adults that emerged the following January and February, which suggests that during seasons of good summer rainfall the skipper may be capable of producing further secondary summer flights in the wild.

### *Herimosa albovenata albovenata*

This skipper and its egg stages were seen during the survey. Eggs only were seen on *Austrostipa cremophila* (Poaceae) growing in the native grasslands 25km west of Yalata. One adult was seen flying

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40km east of Ceduna on the roadside verge of the Eyre Highway, but at 25km northwest of Nundroo the adults were common. At the latter site the adults were more frequent around hostplant that had been eaten partly back by wombats, and unexpectedly were not seen near lush, rank tussocks. A single egg seen west of Yalata was on grass that had been cropped back by wombats and kangaroos to near ground level, and one would wonder how the larvae could survive in such a regime. The adults from this region are darker and smaller than those from around Adelaide.

*Motasingha trimaculata trimaculata* and *Trapezites sciron eremicola*

Although not specifically of interest during the survey, neither of these skippers were seen flying. The former probably starts flying slightly later than the survey period, although the latter skipper should have been flying if present.

NYMPHALIDAE

*Geitoneura klngii*

This butterfly was not seen flying during the survey, which was surprising as during the reconnaissance survey the butterfly was locally very common. Presumably its flight season was delayed due to the effects of the drought and the previous hot summer.

*Vanessa itea*

A single adult was seen flying at Immarna.

LYCAENIDAE

*Candalides heathi heathi*

Although not looked for, this butterfly was noted in flight 17km northeast of Penong and again near the dog-gate on Googs Track. At the latter locality a female was seen laying eggs on *Westringia rigida* (Lamiaceae), a known host-plant on Eyre Peninsula.

*Cyprotides cyprotus cyprotus*

This butterfly was seen flying at only one location 12km north of Koonibba. It was a hill-topping male in freshly emerged condition. Its usual hostplant in the region *Grevillea huegelii* (Proteaceae) was widely distributed. The latter plant was in full flower at Maralinga but no indication of the butterfly or its early stages were seen. Elsewhere the plant was in either pre-bud or early-bud stage. It is suspected the butterfly was just starting its flight period to coincide with the flowering of the *Grevillea*.

*Erina hyacinthina simplex* and *E. acasta*

*E.h. simplex* was seen in flight along Googs Track to the limit of the survey (25km north of the dog-gate) wherever its hostplants *Cassytha melanantha* (Lauraceae) occurred. There are herbaria records of *C. melanantha* occurring at Maralinga and Immarna, but the plant was not found at those localities during the survey and *E.h. simplex* was also not seen flying at the same localities. Strangely however, *E. acasta* was not to be seen during the survey.

*Neolucia agricola*

The preferred hostplant for this butterfly *Eutaxia microphylla* (Fabaceae) is widespread in the region, but



the plant was only in flower north of Ceduna near the dog-gate on Googs Track where the butterfly was seen flying. The butterfly has previously been found at Immarna but was not seen flying in that area during this survey, suggesting the butterfly flies when its hostplants are in flower.

### *Ogyris barnardi delphis*

This butterfly was looked for around its hostplant *Amyema quandang* (Loranthaceae) growing on western myall *Acacia papyrocarpa* (Mimosaceae) in the Yalata and Ooldea areas, but it was not flying. It was suspected that its flying season had not started. The host occurs commonly in the Yalata area, but is isolated from the Gawler Ranges and northern Eyre Peninsula population of mistletoe. The butterfly was also not seen during the earlier reconnaissance survey, but not reported.

### *Ogyris halmaturia*

This endangered butterfly was again (re Grund 2007) not seen, although not much time was spent looking for it. The lack of sighting is believed due to the flight of the butterfly (usually mid October to mid November) being later than the survey period.

### *Ogyris oroetes apiculata*

There are large disjunct populations of its hostplant *Amyema miquelii* growing in the region. A lot of time was spent investigating for the early stages of this butterfly in the Immarna, Maralinga and Ooldea areas, but only two old pupal shells were seen. Ants in the presence of these shells were small black *Iridomyrmex* species. The unusual 'purple-form' male was seen flying (Grund 2007), although interestingly the males were not as purple during this survey. The females were normal blue colour. The adults were seen flying either near their host mistletoe (growing on *Eucalyptus concinna* and *E. yumbarrana*) or feeding at flowering *Myoporum platycarpum* (Myoporaceae). The males tended to fly around the tall canopy of the mistletoe bearing *Eucalyptus*, while the females remained near the mistletoe preoccupied with egg laying. Both male and female adults came down to feed on the *Myoporum* later in the afternoon.

Similar to its relative *Ogyris amaryllis* the butterfly seems to form a phenotypic cline across Australia with respect to morphology and consequently the local population has attributes somewhere between the populations in eastern Australia (nominotypical subspecies), the populations in southwest West Australia (subspecies *apiculata*) and the Central and North-west Australia populations (arid form) (Dunn & Dunn 2006). The local population is presently included under subspecies *apiculata* although there is no sound reason for this.

### *Ogyris otaues otaues*

*Choretrum glomeratum* (Santalaceae) the hostplant of this butterfly was not seen in the survey area. This plant has been reported in some herbaria distributions for this region, but in fact those plants are actually native cherry *Exocarpos* sp. (Santalaceae) that have been inadvertently included under *Choretrum*.

### *Ogyris zosine*

This butterfly was looked for in the presence of *Ogyris oroetes* in the Immarna, Maralinga and Ooldea areas, but no indications of either adults or early stages were seen. Its expected attendant ants *Camponotus nigriceps* were occasionally seen foraging nocturnally on the mistletoe *Amyema miquelii* bearing *Eucalyptus*.

### *Theclinesstes albocincta*

Depauperate *Adriana urticoides* var. *hookeri* (Euphorbiaceae), a hostplant for *T. albocincta* was seen near the Trans Australia Railway half way between Immarna and Ooldea, but no evidence for this butterfly was seen. It would seem the current drought had taken its toll.

### *Theclines thes miskini miskini*

This butterfly was not looked for, but its presence was seen at Immarna and Maralinga.

## CASTNIIDAE

Opportunistic observations were made on the small day-flying sun-moth *Synemon uais*, which was occasionally seen flying in the *Austrostipa eremophila* grasslands 25km north-west of Nundroo, and again 10km west of Nundroo. During the previous reconnaissance survey (not reported in Grund 2007), *S. uais* were seen flying near the Eyre Highway 75km west of Yalata at the east edge of the Nullarbor coastal grass-plain, and again 25km north-west of Nundroo. Larger sun-moths belonging to the *S. discalis*-*S. parthenoides*-*S. sophia* complex based on their known presence in northern Eyre Peninsula, were seen 11km north of Koonibba, and again 10km north of the dog-gate on Googs Track. These large sun-moths were not netted for identification.

## Comment

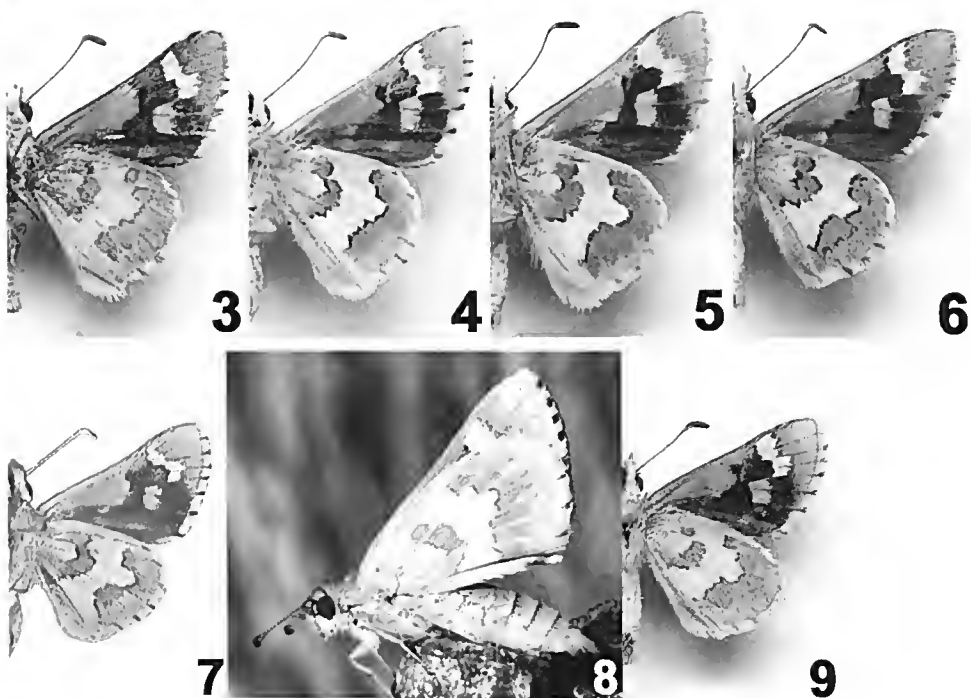
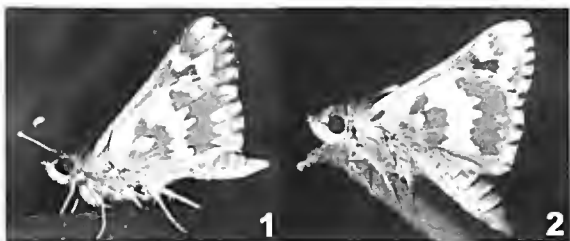
It was noticed many mistletoe bearing *Eucalyptus calcareana* and other mallee trees appeared to be dying immediately west of Yalata, suggestive of either drought stress or the introduction of phytophthora from Western Australia by overnight campers.

## Acknowledgements

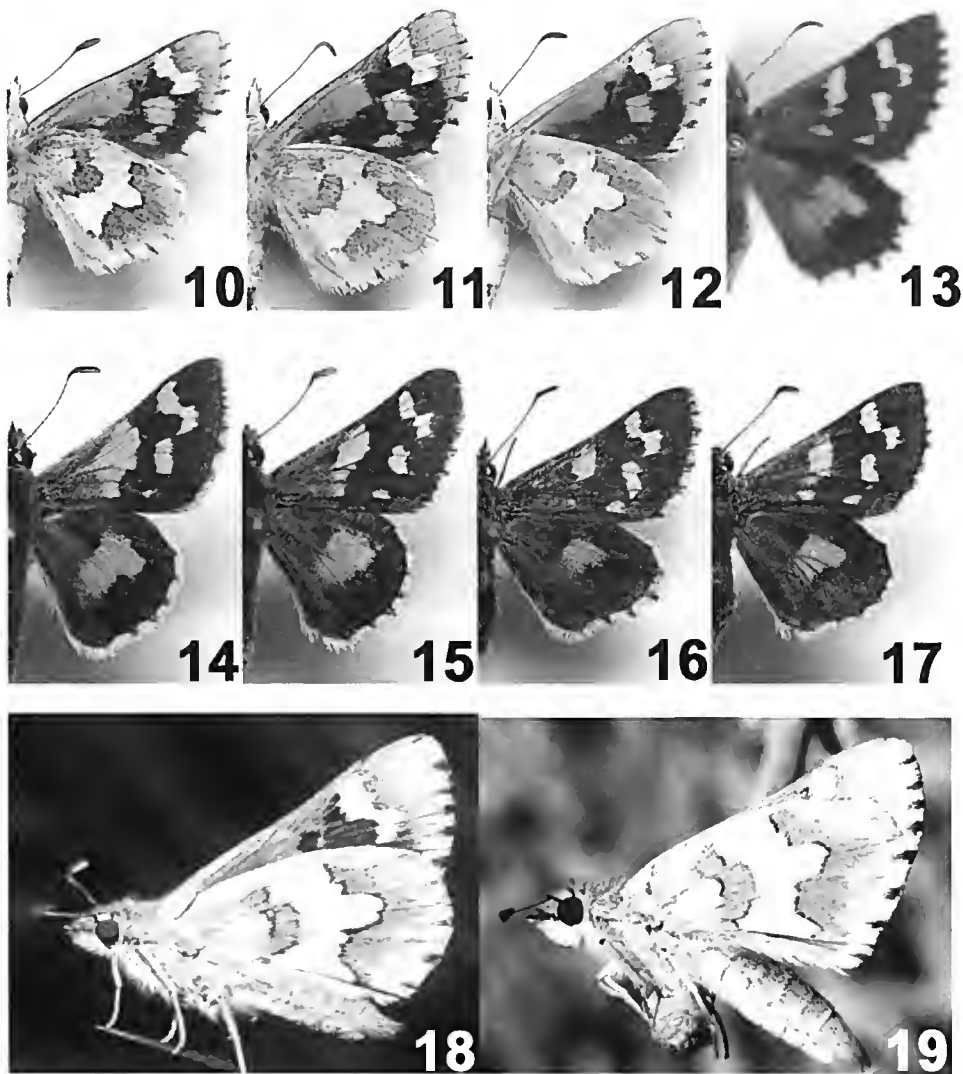
Archie McArthur of the South Australian Museum made the identification of the ants. The late Lindsay Hunt took the image of the *C. arenaria* female from the Far North of South Australia.

## References

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- EDWARDS, E.D. 1979. Two new species of *Croitana* Waterhouse (Lepidoptera: HesperIIDae) from Central Australia. *Aust. Ent. Mag.* 6(2): 29-38.
- GRAHAM, A.J. 1988. The life history of a semi-arid population of *Croitana croites* (Hewitson), (Lepidoptera: HesperIIDae: Trapezitinae). *Aust. Ent. Mag.* 15(4): 123-126.
- GRUND, R. 1998-2009. South Australian Butterflies, <http://www.chariot.net.au/~rgrund/index.htm>, (an information website for South Australian butterflies).
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Figs 1-9. *Croitana arenaria* underside. *C. a. arenaria*; Far North South Australia, male (1), female (2). *C. a. pilepudla*; Immarna m (3), Yalata m (4,5,6), Kimba m (7), Immarna f (8-9).



Figs 10-19. *C. a. pilepudla* underside. Immarna f (10), Yalata f (11-12), Kimba f (18), Middleback Range f (19). *C. a. pilepudla* upperside. Kimba f (13), Yalata m (14), Immarna m (15), Immarna f (16), Yalata f (17).

## Dragonfly genera new to Australia and Queensland (Odonata: Isostictidae, Austrocorduliidae)

Gunther Theischinger, Department of Environment, Climate Change & Water NSW, Water Science, 480 Weeroona Rd, Lidcombe NSW, Australia 2141 [gunther.theischinger@environment.nsw.gov.au](mailto:gunther.theischinger@environment.nsw.gov.au)

**Abstract.** Records from north-eastern Queensland are presented of isostictid larvae most probably representing a species of *Selysioneura* Förster. Species of this genus were hitherto not known to occur in Australia. A larva of *Apocordulia macrops* Watson is recorded from the border between New South Wales and Queensland (Macintyre River). This represents the first record of *A. macrops* from Queensland. Some relevant details of morphology, ecology and behaviour of both species are given.

### Introduction

The most recent keys to the genera of the Australian dragonflies (adults and larvae) and large area distribution maps were given by Theischinger & Hawking (2006), the most recent keys to genera and species (adults and larvae) and preliminary dot maps are included in Theischinger & Endersby (in press). Also relevant in respect of the present paper is a recent treatment of the dragonfly fauna (adults only) of south-eastern Queensland by Nattrass (2006). Larvae of all genera of Isostictidae previously known from Australia are described and illustrated in Theischinger & Hawking (2006) and in Theischinger & Endersby (in press), and so are the larvae of all known species of Austrocorduliidae. However, recently isostictid larvae from north-eastern Queensland could not be identified by using the available Australian dragonfly literature, and a species (larva only) collected in a border river between New South Wales and Queensland had not been recorded from Queensland before. As the recorded larvae belong to very interesting and particularly elusive species, these dragonflies are introduced below in some detail in order to facilitate finding the possibly hitherto unknown adults of the isostictid and to find out more about the distribution of the rare and endangered austrocorduliid in Queensland.

### ?*Selysioneura* sp. (Figs 1, 2)

A Poster on this species was presented under "A peculiar Damselfly larva from Australia" at the 6<sup>th</sup> WDA International Congress of Odonatology in Mexico (Theischinger 2009) in the hope of gaining a second opinion (which did not happen) and to make finding the adults in the near future more likely.

The following material is now available: 3 larvae: 1 ♂, final instar: 1121043, Nth Bamboo Ck d/s meatwork, Queensland, Australia, 11/11/1998, sandy bed, DNR, Qld; 1 ♀, earlier instar: same locality, 22.7.1998, edge, DPI, Qld; 1 ♂, final instar: Rankin Ck, d/s Bora Ck, 12.11.1998, DNR, Qld (both QM). The preliminary identification of the material done by non-odonatologists was Hypolestidae and *Nososticta*, not *solida*; this would now translate to Lestoideidae and Platycnemididae or perhaps Disparoneuridae.

Relevant diagnostic characters in respect of the Australian fauna are: Very small; total length approximately 13 mm. Prementum trapezoidal, ligula strongly produced, median cleft indicated; one pair of premental setae. Labial palp largely parallel sided, bifid, movable hook long; no palpal setae. Prothorax long and flat. Caudal gills large, sausage shaped and swollen, nodate, with basal segment more than three times as long as apical.

Affinities in respect of the world fauna are: The larvae in question very closely agree with the larva of *Selysioneura cornelia* Lieftinck (Fig. 3) illustrated and described from PNG in great detail by Lieftinck (1953). They most probably represent the first record for the genus *Selysioneura* Förster from Australia and an undescribed species. The larvae can be distinguished from all other Australian isostictid larvae by the lack of palpal setae.

At this stage the peculiar larvae are known only from private properties used for the production of, respectively, sugar cane and tea. They may also be present in other tropical lowland streams of north-eastern Queensland which very often are considerably impaired.

Finding the adults should therefore be prioritized and will be a challenge as *Selysioneura* adults are retiring insects with truly arboricolous habits and therefore often difficult to spot (Lieftinck 1953).

#### *Apocordulia macrops* Watson, 1980 (Nighthawk) (Figs 4-6)

*Apocordulia macrops* was hitherto known only from Victoria and New South Wales (Theischinger & Hawking 2006, Theischinger & Endersby in press). During the 2009 autumn sampling for SKA (Sustainable Rivers Audit of the Murray Darling Basin), however, a single larva was collected at Terrewah in the Macintyre River (28.61300°S/149.88312°E). The Macintyre River there represents the border between New South Wales and Queensland so that this is not only the northernmost record of *A. macrops* from New South Wales but also the first record of the species from the Border Rivers Valley (Sub-Catchment) of the Murray Darling Basin and from the state of Queensland. The unexpected record highlights again the importance of programs that monitor river health by demonstrating how they contribute to basic science and zoogeographical and biodiversity research. Even though some of the following information of the peculiar species may help to get more Queensland records of *A. macrops*, from experience - they may take some time to come.

#### Discovery history of *A. macrops*

In the 1970s an unknown dragonfly larva collected during limnological/biological studies of the Murray River got into the hands of Dr J.A.L. Watson (=Tony), then curator of the ANIC (Australian National Insect Collection). He was unable to identify them and right away he collected more material in order to breed out adults. Along the way a few larvae died and were sent to me, then working in the Stadtmuseum Linz, Austria, for help with identification. Tony and I finally agreed that the larvae could be the then unknown larvae of *Archaeophya adamsi* Fraser. Even though we got it wrong, Tony's breeding turned out to be a complete success. He reared several adults, better subadults, representing a new genus and species that he described as *Apocordulia macrops* (Watson 1980). Later, in a paper on the larvae of the Australian Gomphomacromiinae, we (Theischinger & Watson 1984) described the larvae of both *A. macrops* and *Archaeophya adamsi* whose larva I had found in the meantime.

The large eyes and sombre colours of subadult *A. macrops* indicated that it was crepuscular. A few attempts to prove that were unsuccessful as collectors were never really sure if in or near darkness along suitable streams they had heard or seen something, and if that something was *A. macrops* or not. As a last attempt mist nets were used, and an adult male was trapped. However, it refused to take part in a photo session, escaping through the vent of a van. Again Odonatology was left without a photo of an adult *A. macrops*.

Even though larvae of *A. macrops* were found in several southern inland rivers and also in the Gwydir in north-eastern New South Wales (Hawking & Theischinger 1999), attempts to collect adults remained unsuccessful. During a trial study for the SRA (see above) *Apocordulia* larvae were surprisingly found in autumn samples from the Lachlan River at Gooloogong and Lacou near Forbes. Subsequent spring sampling at Gooloogong led to the capture of the first female of the species near darkness and to the realization that adults look much the same as subadults except for having green eyes.

In 2004 on an excursion dedicated to obtaining material of *A. macrops* for DNA studies in Germany finally a few observations, all in or near darkness, on the behaviour of *A. macrops* were made. Several individuals, probably males, flying apparently territorially along the Lachlan River upstream of the Gooloogong Bridge were observed/detected on 2.1.04 between 2030 and 2045 (shortly after the last birds had disappeared from the habitat). The insects flew between 2 and 5 foot high along a rather narrow rocky section of the river, bare on one bank, densely set with willows on the other. On the day after a pair in copula was observed at 0515 moving from mid-stream towards the bank and was collected. Several individuals then behaved as detected on the evening before. By 0535 most of the dragonflies flew at about 10 to 12 foot high, and we were able to collect another male before they disappeared at about 0545. At almost the same time swallows appeared flying wildly along a similar stretch of the river and at similar heights as the dragonflies' flightpath.

From this it appears that *A. macrops* may have a rather narrow window for feeding and reproduction. It can also be assumed that this window may change according to weather and habitat conditions.

#### Brief characteristics and diagnostics

*Apocordulia macrops* is the only known species of the genus that is apparently confined to south-eastern Australia, and all but one record are from the Murray Darling Basin.

Larva (Fig. 4): Total length c. 19 mm. Stout and short. Frontal plate with narrow bilobed apex. Prementum very short and wide. Usually more than 7 antennal segments. Abdomen armed with lateral spines on segments 8 and 9.

Adult (Fig. 5): A medium-sized thick-set dragonfly with large eyes, dully coloured and with pale pterostigma. Triangles of fore- and hindwings crossed. Male anal appendages simple. Female anal appendages very long.

Biological notes: The larvae are generally found on logs and also on rocks in areas of some flow, although early instars may be associated with leaf packs or detritus on gravel beds. The adults are apparently strictly crepuscular.

It may be worth mentioning that according to DNA evidence and interpretation of Ware et al. (2007) *Apocordulia* Watson is classified as a genus of a greatly extended family Synthemistidae.

In this context it is also interesting that the 11 mm long larva of *A. macrops* from Queensland has a very distinct medio-basal groove on the ventral face of the prementum (Fig. 6). This groove was considered useful to separate Libellulidae s.l. from Corduliidae s.l. because it was found present in all studied genera of the Corduliidae s.l. except for *Apocordulia* Watson and absent in all studied Libellulidae s.l. (Theischinger & Fleck 2003). It is now assumed that this groove is absent only in late instar larvae of *A. macrops*.

It has to be assumed that *A. macrops* once was wide-spread in the Murray Darling Basin and that its occurrence is now confined to suitable habitats that have escaped water regulations or where the effects of large scale water regulations are compensated by more natural conditions in small areas. However, being morphologically, ecologically and ethologically one of the world's most fascinating dragonflies and being possibly one of only two endemic dragonflies of the Murray Darling Basin and thus a true Australian icon, makes the continuing survival of *A. macrops* paramount.

## Summary

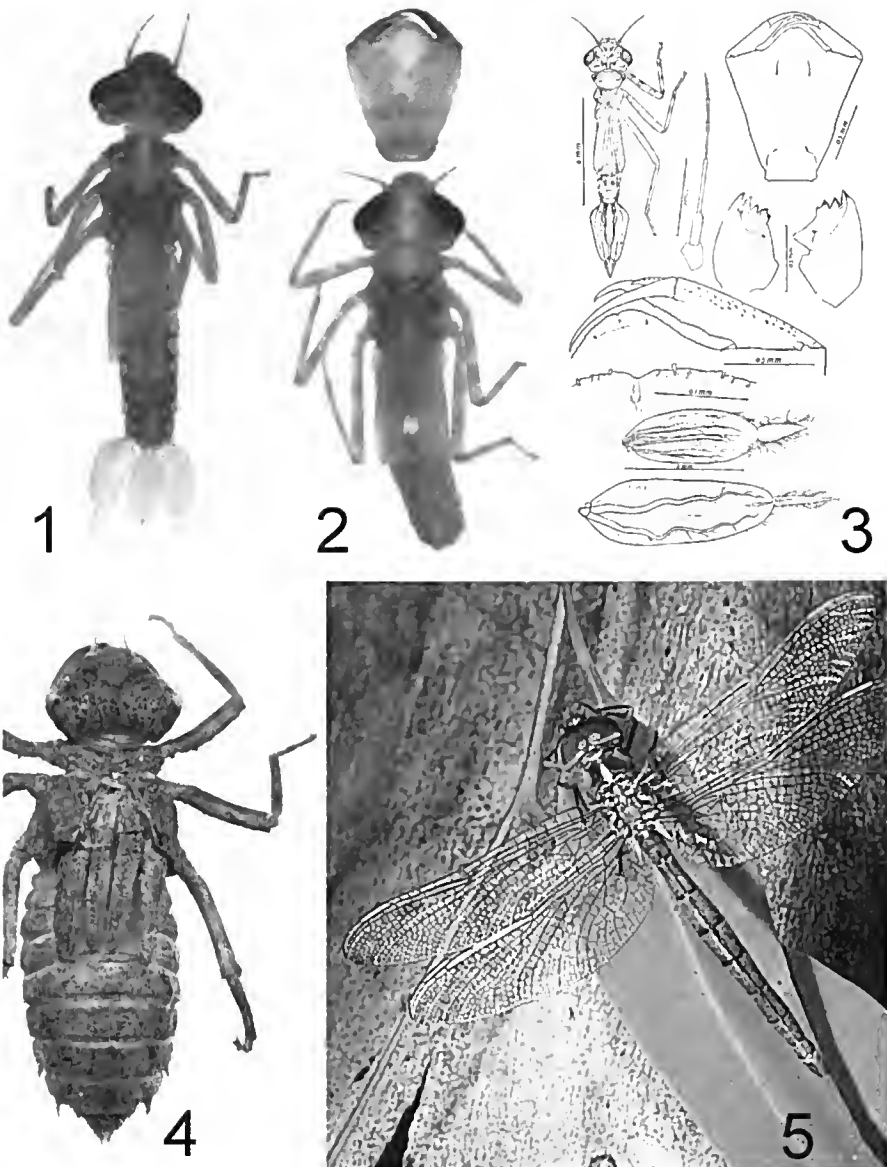
The larvae of the Australian dragonflies are well known at the generic level. By using the available identification keys some larvae recently collected in north-eastern Queensland can be identified to the family (Isostictidae) but not to the genus. These larvae, however, agree in detail with material described from Papua New Guinea as *Selysioncra cornelia* Lieftinck. It is assumed that the larvae from Queensland belong to the genus *Selysioncra* Förster and possibly represent an undescribed species. As the larvae from Queensland are hitherto known only from plantations in private ownership and as the species of *Selysioncra* are very elusive with arboricolous habits of the adults this note is presented in order to draw attention to the possibly as yet unnamed but already endangered species.

A larva of *Apocordulia macrops* Watson, a very little known crepuscular dragonfly species, was recently found at the border between New South Wales and Queensland (Macintyre River). As this species has long been known only from Victoria and southern New South Wales the presence of *A. macrops* in Queensland came as a surprise. It is recorded and relevant details of its morphology and the few observations on its ecology and behaviour are given in order to facilitate finding out more about the distribution and behaviour of *A. macrops*.

## Acknowledgements

I wish to thank Ms Andrea Prior (Toowoomba) for handing over interesting material for study, Mrs Minal Khan (Toowoomba) for information, Mr Glenn Hoyer for allowing me to use one of his photographs (Fig. 5) and Mrs Susan Marchant (Goondiwindi) for permission to access her property for collecting. My wife Christine deserves appreciation for enduring unsuccessful collecting attempts in sugar cane and tea plantations, Dr Jan Miller (Lidcombe) for critically reading the manuscript and Mr Steve Jacobs (Lidcombe) for patience during the preparation of the Macintyre River trip.





Figs 1, 2. ?*Selysioneura* sp., male final instar larva: (1) complete, dorsal; (2) incomplete, dorsal , topped by prementum, ventral. Fig. 3. *Selysioneura cornelia* Lieftinck: complete, dorsal; antenna; prementum, dorsal; mandibles; labial palp, dorsal; median and lateral gills, lateral. Figs 4, 5. *Apocordulia macrops* Watson: (4) final instar exuvia, dorsal; (5) male.

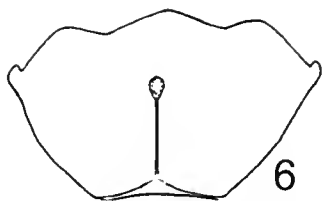


Fig. 6. *Apocordulia macrops* Watson, 11.0 mm long larva from Macintyre River, prementum, ventral.

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# Corrigendum and addendum to the Checklist of the Victorian ghost moths (Lepidoptera, Ditrysia, Hepialidae)

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**Summary.** The publication of a record of *Bordaia paradoxa* Tindale, 1932 from Victoria was found to be based on a misidentification; thus, this species is hereby deleted from the checklist of Victorian Hepialidae. *Abantiades fulvomarginatus* Tindale, 1932, previously known only from Western Australia, is for the first time reported to occur in Victoria.

As part of the 'Checklists of Victorian Moths and Butterflies' project (Marriott et al., 2007), the Hepialidae of Victoria were reviewed and a checklist was published recently (Kallies & Douglas, 2008). After further examination of material held in the F. Douglas collection, it has become apparent that an amendment and an addition need to be made to the original list.

(1) That the taxon that was listed in the checklist as *Bordaia paradoxa* Tindale, 1932 was misidentified. It appears that the single female specimen on which the record was based is an undetermined species of *Abantiades* Herrich-Schaffer, 1885. Although the specimen in question superficially resembles specimens of *B. paradoxa* that are held in the Australian National Insect Collection (ANIC), it was determined (under magnification) that it has unipectinate rather than bipectinate antennae. According to Tindale (1932) this morphological character places the specimen in the genus *Abantiades*.

(2) On 17 April, 1995 a much worn male specimen (Fig. 1) of an unidentified *Abantiades* species was collected by one of us (F. Douglas) at Rainbow. After comparison with material held in the ANIC (Fig. 2) it has now been determined that the specimen in question belongs to *A. fulvomarginatus* Tindale, 1932. This species was only known to occur in Western Australia (E. D. Edwards, pers. comm. 2009) and was not included in the Victorian checklist.

**Acknowledgements.** We wish to express our gratitude to Ted Edwards (ANIC) for his help in the identification of the Victorian *A. fulvomarginatus* specimen and for his consistent support and friendship.

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1



2

#### Figure legend

Fig. 1. *A. fulvomarginatus*, male, Victoria, Rainbow, 17.4.1995, leg. & coll. Douglas (scale: 20 mm).

Fig. 2. ditto, male, Western Australia, 63km E by N of Norseman, 5.5.1983, leg. Nielsen & Edwards (ANIC).

## Fire and the Smaller Animals – a Summary of Don Sands' Presentation

It's worth reminding us of the insects, that most animals (99%) are invertebrates.

In terms of ecology of ecosystems, if you are looking at ecological burns, you must also consider that you are burning animals as well as plants. Indeed, we can use insects and even butterflies to monitor the effects of environmental change as some of them are very sensitive and mobile. Most insects are susceptible to fire.

To survive a fire, an animal has to either escape for find refuge.

Re-establishment requires entry via intact corridors; sustained breeding needs include food, shelters and sometimes symbiotic associations

The reestablishment by insects needs re-entry via corridors that have to be fairly intact. A lot of insects simply won't fly through burnt habitats.

There is evidence that, for example, butterflies won't fly through certain exotic vegetation, for example, pine plantations, but will go around or simply turn back and the same applies to burnt areas.

With regular burnings regimes in Queensland, some of the *Acacia*'s have barely got time to recover themselves let alone produce seeds or develop old growth needed by many insects. When you have large broad scale burns, you have to consider how far the insects have to come in order to recolonise and if the food quality surviving is adequate for breeding.

The interval since burning often governs the rate of regeneration and whether the plants are ready for those insects. The Imperial Blue, for example, likes certain wattles of certain sizes, not too big and not too small. The Delicia Jewel, likes the big old Wattles. It's not just the butterflies that need old growth but the insects belonging to many different Orders.

Those that live above ground are most prone. Often have interconnected relationships and the way they interact with other organisms.

### Poor mobility of stages:

If you think of the way that the bush is burnt in the tropics, burning is mostly done in the cooler months when insect species are inactive. Several recovery plans have gone wrong due to burning at the wrong time and in the wrong place.

Long life cycles can be disrupted by burns. If you consider that some of the tunnelling moths take 3-7 years to develop, and the trees that that much longer to reach maturity, regular burning programs can prevent the host plants reaching the needed stages. Breeding requires time for growth of plant phenotypes (e.g. old growth) or plant senescence

Don illustrated this with images of *Trapezites praxedes* which is very fire sensitive and takes about 7 years to recolonise after fires. Ironically, there is a very closely related species that recovers much more rapidly and is more mobile. Don has observed that as the females patrol to lay their eggs, even if the plants have recovered, if the density isn't right, they will move on.

Don explained that he has lived at the base of Mount Cootha for the past 30 years. There have been many fire events in this time, deliberate and otherwise, and in those 30 years, they have extinction of 7 species; the most recent was about a month ago where the last site for the Fiery Jewel was burnt.

Don explained that on the whole, all insects are fire sensitive; a few able to survive in the short term by taking refuge underground, beneath and between logs and rocks, seed capsules or unburnt stems.

Don then discussed our local Eltham Copper *Paralucia pyrodiscus lucida* ; interesting to look at the interactions. Where the butterfly has a restricted distribution, and the fact the species have a dependency on the ant. The adult being mobile in a short live period of time. The Eltham Copper has a very ancient

line of evolution and remarkably very few species that can bury themselves down with the ants. There are very few insects that naturally live over ground that can go underground at very short notice to escape a fire. This also includes the Bathurst Copper. The foodplant (*Bursaria*) survives the fire and regenerates very rapidly after rain though they have been seen wandering around on the burnt out stems after a fire, and looking very anorexic by the time new growth is available – but, they do survive, a rare adaptation in insects.

Don discussed a rare species, *Trapezites laori* that feeds on *Lomanrda* and has evolved to live on sandstone cliffs where the burning is less frequent. It readily breeds on the regrowth in the burnt areas, but only survives on these sandstone cliffs where the fires can't get to them.

The large Cossids and Hepialid moths take many, many years to recolonise after a fire. It is believed that the species *Endoxyla pulchra* is believed to now be extinct from the lack of old growth trees in an area that was the most systematically subjected to regular burns. The whole area is burnt from end to end every few years without unburnt refuges.

Some of our butterflies have gone from Queensland. Some from weed invasion, some from lack of water table/ climate, but a lot from burning sensitive areas.

*Argreus hyperbius inconstans* – the Australian Fritillary – now believed to be gone from Queensland's coastal wetlands. The loss is believed to be partly the result of burning programmes

### Hilltops:

Hill tops are a worry as many species, not just butterflies, need hilltops to not only find a mate but for sustaining their genetic variance. The most competitive males usually win on a hilltop and this plays an important part for evolution.

By burning hilltops we destroy the habitat for species that travel many kilometres to get to these sites which are very sensitive.

The Bullock Jewel *Hypochrysops piceatus*, possibly the most endangered butterfly in Australia, only has three main sites which are still being broken up and fragmented. This butterfly lives in the top of the tree canopy. This species, as like most of the Blues, have specific ants that are needed for the life cycle. In this case, it is the ant that is threatened as it lives in and around damages trees and doesn't go underground.

### Not just the Butterflies:

Let's not forget all the other insects and not just the butterflies. There is a huge variety of Chrysomelid beetles, for example, that participate in effecting the architecture by feeding on the eucalypts. And a huge number of undescribed species and incredibly important in the whole Eucalypts and Acacia ecosystems.

We have threatened and rare species where if fire effects the plants in any way we lose the species and also the architecture of the plant. It's worth considering how the indirect ways that fire can effect the survival of insects.

Rare *Spiloyra* breeds only if fire is excluded from the moist habitats.

One of the topics that we need to look at very carefully are the group of insects that break down the leaf litter. In Queensland, when people measure fuel load, they use the centimetre scale and look into the leaf litter.

We have to look at the moths and their roles at the Australian Earthworm.

We don't have the northern hemisphere earthworms in Australia that do the breakdown of dry leaf litter. We have a range of organisms, mainly moths (5,000 species of them), that range from one end of Australia to the other.

And they could have in any one area, up to 400 species and are very active in breaking down the very dry leaf litter. Some will even start with leaves still hanging on broken branches. They are basically our earthworms.

There are also a lot of Cryptocephaline beetles that do a similar job. They do live in the canopy and some can escape fires.

The problem with the Oecophoridae species that although they are winter breeders and their most sensitive stage is spring when most of the burning is done.

It takes many years for them to recover. These critically important groups of insects appear to have been overlooked. These are literally the natural fuel reducers. If you burn regularly you lose them and can actually enhance the fuel build-up.

Insects are also very important in the nutrient recycling process. A PhD student is currently working on Koala's in Brisbane.

Don's presentation showed some interesting figures:

- 438 Lepidoptera larvae per m<sup>2</sup> were recovered from leaf litter in wet sclerophyll forest (Plowman 1979)
- 54 - 252 Lepidoptera larvae in leaf litter samples (ca. 130 g dry weight) at Depot Beach (ANIC & IFB Common) (& see Edwards 2007, pp 74-75).
- 80-95% of these larvae were Oecophorids (12-19 species) with consistently higher densities present in sheltered litter

#### Wetlands:

We seem to have a problem with invasive grasses, more so in the northern regions, than in Victoria.

In Queensland alone, we have about 15 species of invasive grasses that are promoted by regular burnings. Don showed an area that had Molasses Grass, and over a period of three years burnings, none of the native grasses were present any more and the fuel load has increased over 100 fold.

In the NT, the burnings are very regular making it very difficult for the grasshoppers to survive. Even if they do survive, the exotic grasses including Gamba Grass have taken over and displaced the native foodplants and are very flammable. You have to think about what the difference is between the fuel load of native vegetation and the exotic species.

Melaleuca wetlands are currently down for regular burnings. Don passed around information from a Queensland fire of a Melaleuca wetland (though not from a regular burning). Melaleuca wetland that had been unburnt for a long time also support rare orchids.

These areas are planned by diary for when to burn.

Boronias are very sensitive indicators; we've seen a species in Queensland disappear from several wetlands, *Boronia falcifolia*, from too frequent burning which forms thickets but due to regular burnings has become a rare species.

#### Grasslands:

Don had previously passed around a picture showing a piece of land that was burnt (it was a patch of native grass); and the only remaining grass there now is Molasses Grass. Burning often created an opportunity for these exotic grasses to take over. Part of the problem, purely based on observation, is that these grasses don't have any herbivores to break down the leaf litter. It's the leaf litter under these big grasses that makes the big fuel load.

Molasses grass, grows to 3 metres, it's the top section growing on its own dead leaf litter because there is nothing to break it down. Some people that have monitored Molasses grass found nothing in the way of invertebrates to break it down, at least with some other grasses you get some herbivory. One of the challenges now is how to control these really vigorous flammable grasses and their fuel loads that are up

to 10 times or more greater than the natives – because they're kept under biological control by their own herbivores. Such as the Leichhardt's Grasshopper that i.e. believed to be close to extinction.

Heathlands being very flammable. Hilltops just the same, and grasslands too. Some of the northern grasslands get hit by lightening every year and burn, and one could as if this is natural or not.

We seem to have a problem with invasive grasses, more so in the northern regions, than in Victoria. In Queensland alone, we have about 15 species of invasive grasses that are promoted by regular burnings. Don showed imaged of an area that had Molasses Grass, and over a period of three years burnings, none of the native grasses were present any more and the fuel load has increased over 100 fold. The more you burn it the more it will burn!

### Fire Ecology:

Fire ecology as it has developed so far has really left the insects out of the equation. It's worth having a revisit of what happens when plants have been burnt.

There's a bit of a theme out there that to burn the Australian bush is a natural process and something that it thrives on and responds positively. But if you look at it more closely, there is a lot of doubt as to flammability, frequency, scale and intensity.

In a recent discussion about Banksia's and Hakea's. Do they need fire to reproduce? There is a general belief in the community that they do need fire to reproduce. No one seems to have asked an entomologist on what his opinion is.

Don has been to many places that haven't been burnt for 70 or more years, where Banksia's were reproducing because the dead lower branches were hanging down and the seed capsules could escape. In the case of Hakea's, its nearly always insects that ring barks the stems, and the ring barking sets of the same process as fires, the branches die and the capsules open to free the seeds.

Don urged us to be careful you don't get misled by people saying that all plants have to be burnt to reproduce. Some heathlands look unhealthy to us because they haven't been burnt for many years, but that does not mean the plants are not reproducing.

Look at what happens in plants that don't need a lot of frequent fire, like Christmas Bells on the East coast which are very fire sensitive.

Equally, some plants will respond positively after fires; Banksia, Hakeas and even some orchids that visually reproduce after fires, with adequate moisture and extra light.

Think too about the plants that aren't able to survive from being burnt. There are many plants that reproduce from rootstock but they don't all do that.

And neither do all the Eucalypts. We hear that Eucalypts reproduce by producing epicormal growth or by root suckers, by many don't do this at all; they have to depend on seeds, or seed banks.

So what happens in a species like Mountain Ash. If you bur it regularly, it doesn't get time to seed unless it has been there 40 or more years. And if you burn the seed bank, you can kill the trees by fire. There are many species like this that cannot be burnt at regular intervals as they don't have time to put down a seed bank and they just die and disappear. Many fire sensitive plants that decline in density may change their growth even if they survive the fire.

A lot of species, when they're burnt, you don't get a single trunk afterwards, you get a malee type of formation that is not good for insects and not typical of the way the plant should grow.

As an example of a fire sensitive plant, The Richmond Birdwing vine, *Pararistolochia*, is probably one of the most sensitive vines they have come across.

It is sensitive to a lot of things, if you go to a vine and cut it below the last leaf, it will die. If you burn it, it will die. And there are a lot of rainforest plants in Queensland, and probably in Victoria too, that never



come back. If they haven't got any means of seed dispersal, it doesn't move far at all. Macadamia are a classic example of a fire sensitive plant. The seeds aren't moved very far unless by rats. So they don't have big mobility. It is very easy to destroy species. There must be lots of others that we don't know much about.

Of the many ways that fires start, perhaps from a lightning strike on a dead limb, that smoulders. It is man that starts the most fires, whether deliberate or by accident.

#### **Aboriginal practices:**

How many times have we been told Captain Cook went down the coast and met a country that is covered in smoke everywhere? Yet, you talk to anthropologists; they have a different view that this was their main ways of signalling, and probably warning of the whites coming.

Unfortunately, very little information is available on traditional use of fires.

It is understood that most of the fires were only done in certain areas, there was very little burning at all in the coastal woodlands. They were terrified of starting a fire and managed it very, very carefully.

Of that information that we can obtain, from the far northern Australia, where the fires are believed to have been used on a very small scale. And in Central Australia too, there is evidence that they burned only 2-3 hectares at a time.

Quite an interesting challenge to see if we can extract from our and their history in managing fire.

We appear to be very conscious of our carbon monoxide output, yet we don't seem to measure the CO<sub>2</sub> output of the fires that we start and attempt to manage.

#### **Micro mosaic patch burning:**

Understood to be the most likely traditional method of burning – which the traditional people stopped doing as the farmers said the larger scale burning was more efficient. Of course, they were to clear farmland as opposed to managing the native land.

For the Gouldian Finch in northwestern Australia, given they feed only on natives grasses, and all through the year, requires seed production at different stages all through the year.

The only way to do this is a mosaic fire pattern. This also protects the tree hollows for nesting. Were told that these are only as few metres of the ground and are every vulnerable to fire. The traditional people are saying that this is the way they used to do it. And this certainly seems to be the way they did it to keep the fire diversity that we currently have.

Now that we are re-doing this mosaic fire pattern, it is bringing the Gouldian finch back from the brink of extinction. Coincidence?

We believe the traditional people must have used the mosaic burning patterns, they wouldn't have had motorized vehicle to get around and would have needed to protect their area for food, fire breaks, wildfire disruption and camping, by managing only small burns.

No matter how much fuel reduction burning we do. Micromosaic burning of course won't help with a raging canopy fire driven by extreme weather events.

#### **Conclusion:**

- Don does not believe threatened species habitats should be burned at all. There should always be unburnt refuges, an area set aside. Fire use should aim to simulate the most likely natural regimes from occasional lightning strikes and exclude from burning areas that do not burn, or rarely burn naturally.
- Pre and post burning surveys otherwise we don't know what the burning is doing to the plants and animals.
- There is a habit on some states where fires are left to burn themselves out. Don feels that we should never allow this to happen anywhere.
- Recognizing the value of fire retardant plants. There are plants that don't burn very well and are very fire retardant. They won't stop fires but could help especially with stopping wind-borne embers.
- Don thinks there is a big connection between fire, insect biodiversity, conservation, and perhaps even the management technique we use in handling some of our fires. At the same time, Don doesn't think there is a single thing we can do to stop the climate driven fires we have seen in the southern States or on the southern Sunshine Coast in 1994. Only actions to stop the fires being lit at the wrong time will help.



*Seasons Greeting to all readers and members from the  
Council of the Entomological Society of Victoria*



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